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INSTITUTE OF GAS TECHNOLOGY

THE GAS INDUSTRY'S OWN EDUCATIONAL AND RESEARCH FACILITY

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GAS ABSTRACTS

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1. GAS INDUSTRY

Education

Elliott, M. A. EDUCATIONAL ACTIVITIES OF THE GAS INDUSTRY. Amer. Gas Assoc., Gen Managmt. Section Conf., Chicago, (1956) April 4-6.

After a brief review of the record of the gas industry in supporting the training of gas engineers, the author discusses the general problem of engineering education. The services of the Institute of Gas Technology in such education is outlined, with a discussion of the programs for undergraduate, graduate, home study and summer refresher courses. Plans and costs for an expansion of these services are mentioned. O. P. Brysch

Frasher, J. A. THE OTHER SIDE OF THE ENGINEER SHORTAGE. *J. Petrol. Techn.*, 8, 42 (1956) May.

The author suggests that much of the hue and cry about shortage of engineers would be unnecessary if the law of supply and demand was given free play. Reference is made to the medical profession's apparent efforts to maintain a shortage of doctors. Misuse of engineers is a factor suggested as contributing to an apparent shortage which may in fact not exist. Adequate pay and true professional status are suggested as approaches which would remedy the shortage without using gimmicks to attract people into the field. R. T. Ellington

Nuclear Energy Growth

COMMERCIAL ATOMIC ENERGY. *Gas Age*, 117, 36-38, 62 (1956) April 5.

Competition for commercial atomic power is under way both nationally and internationally but development as a major near-term source of fuel for electric power generation is unlikely. In view of the rather small percentage of oil and natural gas used for purpose of generating electricity there is no threat of a significant loss of revenue by the oil and natural gas industry due to growth of atomic power. Economical aspects of the atomic energy is considered and it is estimated that until 1970 atomic energy will not be considerable in the power industry. G. Kunst

Portland Service Crisis

TEAMWORK SOLVES PORTLAND SERVICE CRISIS. *Gas Age*, 117, 19 (1956) April 5.

An oil fire in the Portland Gas and Coke Co's. Linnton generating plant left an estimated 200,000 persons without gas. The fire burned only 20 minutes but it knocked twelve 20 ft generators out of service. Mains accumulated charges of air. The company's only course was to shut off service to each user, then go back and restore it when the mains were charged. The job was gigantic but with the help of the whole gas industry which sent crews of workers the service was restored in 6 days. This was an example of the dependence of the community on the gas service and how to beat an emergency. G. Kunst

Regulation

Abrams, E. R. THE OUTLOOK FOR NATURAL GAS EARNINGS. *Public Utilities Fortn.*, 57, 668-72 (1956) May 10.

Average earnings of 35 gas companies show a 23.65 per cent increase over 1954 for 1955. The general outlook is good and there is no reason to believe that government regulation of the producer will wreck the industry. W. G. Bair

Welch, F. X. IS FPC GAS PRODUCER REGULATION HERE TO STAY? *Public Utilities Fortn.*, 57, 505-08 (1956) April 12.

The author concludes that FPC regulation of the gas producer is here to stay and urges that the three interested parties, producer, pipeline, and distributor, get together and work out some form of equitable legislation that Congress can pass. This would embody some form of FPC control. W. G. Bair

T.I.P.R.O.A. HOW CAN GAS PRODUCERS LIVE WITH FPC CONTROLS, RATABLE TAKE? *Oil Gas J.*, 54, 74, 75 (1956) April 23.

The tenth annual meeting (Dallas) of the Texas Independent Producers and Royalty Owners Association concerned itself chiefly with Federal control. Objections to regulation are the high cost of preparing cases for the commission, and of compiling statistics of operations. Arguments for and against the Texas ratable take are sketched briefly. O. P. Brysch

2. APPLIANCES

Air Conditioning

RESIDENTIAL GAS AIR CONDITIONING EQUIPMENT. *Amer. Gas J.*, 183, 24-27 (1956) May.

Four makes of residential gas air conditioners are now available or in final testing stages; on their success the gas industry is pinning its hopes for building summer loads and increasing its market. Author's Abstract

Burner Design

Kraemer, P. W. WANTED: DIRT-FREE ENGINEERING DESIGN. *Gas Age*, 117, 24-25, 52, 53 (1956) May 17.

The change mandatory in every burner and every control design is that of a dirt-free engineering design or application, because 55 per cent of all gas appliance trouble service is caused by foreign matter, even in a low air-contaminant situation such as in Minneapolis. Author's Abstract

Controls & Ignition

Eadon-Clarke, C. E. (assigned to International Standard Electric Corp.) GAS BURNER SYSTEM HAVING TIME CONTROLLED AIR AND FUEL SUPPLY. U. S. 2,743,771 (1956) May 1.

Heiser, F. F., McCarty, V., and Vicenzi, R. L. (assigned to A-P Controls Corp.) GAS FLOW CONTROL. U. S. 2,743,871 (1956) May 1.

Hoff, J. M. (assigned to The Tappan Stove Co.) AUTOMATIC IGNITION MECHANISM FOR GASEOUS FUEL BURNERS. U. S. 2,744,569 (1956) May 8.

Matthews, R. B. (assigned to Milwaukee Gas Specialty Co.) SAFETY SHUT-OFF AND AUTOMATIC CONTROL DEVICE FOR GASEOUS FUEL BURNERS. U. S. 2,742,915 (1956) April 24.

Miles, G. N. (assigned to Jet-Heet, Inc.) GAS FIRED HEATING SYSTEM. U. S. 2,744,517 (1956) May 8.

Electric House Heating

Becker, A. J. ELECTRIC HEATING IS BECOMING A REAL THREAT. *Butane-Propane News*, 18, 76-82 (1956) April.

An all-out battle for the house heating load is imminent. In order to show a satisfactory return on invested capital, the electric utilities must either obtain higher rates generally or build a winter load to equalize the summer peak. Case histories show that electricity is becoming a serious competitor when reasonable rates are combined with aggressive promotion.

S. Close

Kitchens

Huck, M. E. BUILT-IN KITCHENS ARE GREAT—IF THEY ARE PLANNED RIGHT. *Gas*, 32, 81-82, 86, 88, 91-92, 94-96 (1956) May.

Subdividers are turning to built-in kitchens as an added sales feature. They can be the answer to the housewife's prayer—or they can become first-class booby traps. Some first-class planning is required to make the built-in kitchen the efficient working area it should be. The main thing to remember—give the housewife some working space. Two feet of counter area isn't enough. Author's Abstract

Gas vs. Electric Cooking

GERMAN TESTS SHOW ADVANTAGES OF COOKING WITH LPG. *Butane-Propane News*, 18, 74 (1956) April.

Extensive and carefully controlled tests conducted by the German Institute of Nutrition Techniques showed that one pound of propane used in cooking does the work of 4.3 kw/hr of electricity. These results are in sharp contrast to the Beltsville findings reported in Technical Bulletin No. 1073, issued by the U.S. Department of Agriculture; wherein, it was reported that one pound of propane gas was equal in energy to only 3 kw/hr of electricity. The test also showed gas to be faster and more economical than electricity even when used by an inexperienced housewife. S. Close

Law for Contractors

Parker, L. T. HOW HIGHER COURTS HAVE RULED. *Air Cond., Heatg. and Ventil.*, 53, 74-77 (1956) April.

Cases decided by the higher courts, of interest to heating contractors and manufacturers, are

reviewed in this article. The cases are briefly described and the essence of the legal opinion stated. Similar court cases are listed.

Author's Abstract

Test Equipment

Farquhar, W. A. "HOT ROOMS" TEST THERMODYNAMIC UNITS. *Ind. Lab.*, 7, 12-13 (1956) March.

Three "Hot Rooms" have been constructed at the Underwriters' Laboratories for testing refrigeration and air conditioning equipment at single and dual ambient air-to-air tests, as well as air-to-water tests. Conditioning equipment for the rooms is designed to maintain various combinations of dry bulb-wet bulb conditions of air.

S. Close

Water Heating

Segeler, C. G. GAS VS. OIL IN SUMMER-WINTER HOOK-UPS. *Gas Age*, 117, 32-36 (1956) May 17.

In some markets tankless coils attached to gas boilers furnish acceptable competitive service; there is great doubt on competitive sales claims based on limited studies; thus, care is recommended in training salesmen to stick to statements which can be backed up by facts on fuel allocation to water heating and to space heating.

Author's Abstract

3. COMBUSTION AND INDUSTRIAL FURNACES

Flame Research

Bollinger, L. E. and Edse, R. EFFECT OF BURNER-TIP TEMPERATURE ON FLASH BACK OF TURBULENT HYDROGEN-OXYGEN FLAMES. *Ind. Eng. Chem.*, 48, 802-07 (1956) April.

A study of flashback of turbulent H_2-O_2 flames and its correlation with the boundary velocity gradient indicate a dependence on ambient conditions. The results as yet can only be viewed in qualitative terms. The critical velocity gradient was found in general to increase with burner diameter with one exception that appears to be experimentally reproducible. The critical gradient was found to depend on the material of the burner in a manner indicating a dependence on burner tip temperature primarily. Variations also resulted when the flames were studied in a closed room rather than in an open area. In this instance, the less stable flame (in the limited surroundings) corresponded to the lower burner tip temperature indicating some dependence on the nature of the surrounding gases.

S. A. Weil

Kurz, P. F. RICH BLOW-OFF OF HYDROCARBON MIXTURES ON A BURNER SHIELDED BY AN INERT GAS. *Fuel* (British), 35, 137-145 (1956) April.

Six binary hydrocarbon mixtures containing ethylene as one fuel component showed evidence of inhibition at the rich blow-off limit. The inhibition is ascribed to the anomalous behaviour of ethylene flames at the rich limit. Some mixtures containing isobutane as one fuel component also showed slight inhibition. However, the inhibiting influence of the branched chain hydrocarbon was not generalized. Other binary mixtures showed no evidence of inhibition at the rich limit. Further work is indicated, especially with acetylene as one component of the fuel mixture.

Author's Abstract

Maccallum, N. R. L. FLAME BLOW-OFF FROM RECTANGULAR BURNERS. *Fuel* (British), 35, 169-77 (1956) April.

As the literature on flame blow-off of rectangular burners contains discrepancies, the blow-off limits have been obtained for six burners of cross-sectional dimensions ranging from 0-2 cm x 0.3 cm to 5.1 cm x 0.3 cm. Observations of flame lifting from the long side of the burner port have been correlated by the wall velocity gradient calculated at that point, it being assumed that the flow follows the Poiseuille law and that velocity profile is unaltered by the presence of a flame. Final flame lifting values have also been roughly correlated by the average wall velocity gradient obtained from the pressure drop in the burner channel. This correlation is not limited to laminar flows. The friction coefficients have been measured for the burner channels and, in the laminar flow range, they are found to be inversely proportional to the Reynolds number.

Author's Abstract

Walker, P. L., Jr. CORRELATION OF EQUILIBRIUM ATOM AND FREE RADICAL CONCENTRATIONS IN FLAMES OF CAR-

BON MONOXIDE, HYDROCARBON AND AIR WITH BURNING VELOCITIES AND FLAME STABILITIES. *Fuel* (British), 35, 146-60 (1956) April.

A correlation of the equilibrium atom and free radical concentrations with burning velocities and flame stabilities in mixtures of carbon monoxide, propane and air and in mixtures of carbon monoxide, methane and air is found to be lacking. Furthermore, the simplified "square root law" equation fails to predict the sharp increase in burning velocity of carbon monoxide flames with addition of small percentages of propane. Author's Abstract

Weinberg, F. J. LOCATION OF THE "SCHLIEREN IMAGE" IN A FLAME—TWO-DIMENSIONAL FLAMES. *Fuel* (British), 161-65 (1956) April.

Following previous calculations of the position at which maximum deflection of an incident ray of light occurs in a flat flame, this position is now considered in the case of a two-dimensional curved flame. It is shown that the problem can be treated simply by regarding the flame surface as consisting of small flat facets. This treatment applied to some simple configurations yields expressions for the axial temperature at which maximum deflection occurs. The expressions show that this temperature lies between the values of initial temperature and 1½ x initial temperature (°K), in air, for flames concave to the approaching gas stream, but in practice is usually very close to the latter values. Author's Abstract

Gas-to-Oil Conversion

CONVERSION FOR GAS CONSUMERS. *Nat. Petroleum News*, 48, 171 (1956) April.

To improve their competitive position, one petroleum company developed an oil burner intended to replace gas burners in gas designed units for promotion of gas-to-oil conversion. R. T. Ellington

Gas Turbine Power

Pfenninger, H. REPORT ON BEZNAU—LARGEST OF ITS KIND. *Power*, 100, 75-78 (1956) April.

A 40,000 kw gas turbine electric power station has been operating in Switzerland for 7 years. The costs of operating the gas unit are much lower than a steam driven installation. No trouble spots developed during operation. The practicability of the units for peak load operation is demonstrated. W. G. Bair

Ore Reduction

Gilliland, E. R. (assigned to Esso Research and Eng. Co.) ORE REDUCTION PROGESS. U. S. 2,742,352 (1956) April 17.

Process for reducing metal oxides of the iron type, said oxides existing in the form of a higher oxide and a lower oxide, which comprises supplying finely divided higher metal oxide to a first heating and partial reduction zone, supplying a gaseous hydrocarbon-containing fuel mixed with lower metal oxide from a second reduction zone to said first heating zone, admixing combustion-supporting gas with said gaseous fuel as it is passed from said second reduction zone to said first heating zone, maintaining the metal oxides in fluidized state in said first heating zone, burning the fuel with the combustion-supporting gas in the presence of the metal oxides whereby the higher metal oxide is reduced to a lower metal oxide and sensible heat is imparted thereto, removing fluidized hot lower metal oxide from said first heating and partial reduction zone directly to the second reduction zone, supplying to said second reduction zone gaseous hydrocarbon substantially free of combustion-supporting gas to reduce the lower oxide to metal in said second reduction zone, controlling the velocity of gases passed through said second reduction zone so that the solid contents therein are maintained in a fluidized metal oxide base and a separated metal phase, removing a stream of the metal from said second reduction zone, and returning unreduced lower metal oxide from the second reduction zone mixed with hydrocarbon-containing fuel gas from said second reduction zone to said first heating zone. (See also, Ogorzaly, H. J., U. S. 2,742,353 and 2,742,354) First Claim

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Mallette, F. A. AIR POLLUTION. p. 140
Daniels, F. SOLAR ENERGY. p. 140

4. CARBONIZATION AND GASIFICATION

British Gas

Dyde, J. H. GAS PRODUCTION DEVELOPMENTS. *Gas J.* (British), **286**, 122-24, 127-28 (1956) April 11; *Gas World* (British) **143**, 580-85, March 10; 634-39, March 17; 688-91 (1955) March 24.

The shortage of good gas-making coals and their greatly increased price has provided an incentive to find new techniques for the production of gas. Plants have accordingly been designed and are now going through extensive development stages for the production of gas from a wider range of coals and also from petroleum products, which have become more readily available by the establishment of oil refineries in England. New techniques in producing town gas are outlined in the article.

Author's Abstract

Coal Properties

Hinshelwood, C. THE CARBON OF COAL. *Brit. Coal Utilis. Res. Assoc. Gazette*, No. 27, 3-10 (1956).

This is the Fourth Coal Science Lecture before the B.C.U.R.A. and concerns many of the physico-chemical problems in conversion of coal. A brief explanation of coal structure is followed by sections on activated charcoals, sorption of oxygen and its compounds by carbon, catalytic effects in carbon-steam-carbon dioxide reactions, and pretreatment of active carbons with acids.

E. B. Shultz

Kear, R. W. and Menzies, H. M. "CHLORINE" IN COAL: ITS OCCURRENCE AND BEHAVIOR DURING COMBUSTION AND CARBONISATION. *Brit. Coal Utiliz. Res. Assoc. Monthly Bull.*, **20**, 53-65 (1956) February.

Work on the occurrence, state of combination, origin, removal by washing, and behavior of chlorine in coal during combustion and carbonization is reviewed. Chlorine is present almost entirely in the inorganic form, but only partly as chlorides of the alkali metals. Interest in chlorine content of coal is concerned with its pernicious effect within combustion and carbonization appliances, and with its contribution to atmospheric pollution.

D. M. Mason

Dutch Coke Ovens

Van Waes, J. P. M. and Quanjel, H. E. THE NEW "EMMA" COKING PLANT OF THE NETHERLANDS STATE MINES. *Coke and Gas* (British), **18**, 83-87 March; 117-22 (1956) April.

In October 1954, the new "Emma" coking plant, replacing the old Emma-Heerlen shut down in 1945, began operations on its new site near Mauritz, in western South-Limburg. The new plant of 2 batteries, each of 75 ovens, is integrated with the Mauritz coking plant with respect to power supply and chemical works. The Wilputte underjet ovens carbonize 3000 tons a day, producing metallurgical coke. The ovens and coal handling system is described in the first installment. The second installment covers features of the cooling, ammonia recovery, benzole recovery, oxygen plant and slagging gasification plant.

O. P. Brysch

Gasification

Binford, J. S., Jr. and Eyring, H., KINETICS OF THE STEAM-CARBON REACTION. *J. Phys. Chem.*, **60**, 486-91 (1956) April.

The kinetics of the water gas reactions $C+H_2O=CO+H_2$, was investigated experimentally at temperatures in the range 900-1300°C and pressures of 1-100 microns Hg employing a spectroscopic graphite electrode carbon. For temperatures in the range 900-1100°C, the reaction was found to be zero-order with an activation energy of 60.3 Kcal/mole, becoming a first-order reaction at 1200-1300°C with a much lower activation energy. A surface rearrangement of adsorption sites and a pre-dissociation of the steam are discussed as possible mechanicism for the reactions.

E. J. Pyrcioch

EINWEIHUNG DER DRUCKVERGASUNGSANLAGE DORSTEN. (INAUGURATION OF THE PRESSURE GASIFICATION PLANT AT DORSTEN). *Erdoel u Kohle* (German), **8**, 925 (1955) December; *Gas und Wasserfach* **97**, 264-272 (1956) April 1.

After test-runs since September, a ceremonial start-up of the complete 6-generator pressure gasification plant by officials of Steinkohlengas A-G. and the parent company, Ruhrgas A-G. took place on December 19, 1955. The plant is located at Prince Leopold-Baldur mine at Dorsten, north of Essen. Based on the oxygen

gasification process of R. Drawe, further developed by use of pressure and steam by O. Hubmann and F. Danulat with the Lurgi Ges. Waermetechnik m.b.H. for brown coal gasification, the plant, now adapted to coking- and gas-coals, has been under construction since 1953. Using gas coals (335,000 tons/year) and 225,000 cu m (7.88 mill CF) oxygen/day, the plant is estimated to yield 500 million N cu m (about 18 billion CF) of 3900 kcalorie (400 Btu) gas per year. The gas under 20 atm passes through washer-coolers, waste-heat exchangers, solution heaters, *alkazid* H_2S scrubbing, pressure desulfurization, potash CO_2 scrubbing and dehydrators, after which it is mixed with 15 percent of 900-Btu natural gas and enters the Ruhrgas grid system at 460 Btu. Annual byproduct yields are 2500 tons phenols, 8000 tons tar, 4000 tons light oils and 200,000 tons $(NH_4)_2SO_4$. If costs prove equal to coke-oven gas, a doubling of plant capacity is planned. O. P. Brysch

Inert Gas

Pomykala, E. S. SEPARATION AND PURIFICATION OF NITROGEN AND OTHER INSOLUBLE GASES FROM FLUE GASES. U. S. 2,740,693 (1956) April 3.

A method is described for purification of flue gases, and use of the treated gases to prevent spontaneous combustion in large coal piles. The process requires contacting the hot flue gases with a fine alkali water mist followed by separation of dissolved material. B. E. Eakin

Natural Gas Substitutes

Shultz, E. B., Jr., Channabasappa, K. C., and Linden, H. R. HYDROGASIFICATION OF PETROLEUM OILS AND BITUMINOUS COAL TO NATURAL GAS SUBSTITUTES. *Ind. Eng. Chem.*, 48, 894-905 (1956) May.

The conversion of residual petroleum oils and low rank coals to high heating value gases by direct hydrogenation was investigated as a means for supplementing the increased demand for pipeline gas during the winter months. It was demonstrated in a laboratory batch reactor that 80 to nearly 100 weight per cent of residual petroleum oils, and 60 to 80 weight per cent of a high-volatile B bituminous coal could be converted at high rates to methane-rich, essentially olefin-free gases of 800 to 1100 B.T.U. per std cu ft heating value at 1200° to 1350° F. and 1400 to 4400 lb per sq. inch gage in the presence of 16 to 35 std. cu ft of hydrogen per lb of feed. The data indicate that a commercial process for the direct conversion of residual oils to natural gas substitutes can be developed. High pressure hydrogasification of low rank coals appears to be more difficult because of the lower rates of gas production and problems of coal charging and ash removal. Authors' Abstract

Oil Gas

Bausch, H. OELSPALTUNG ZUR SPITZENGASERZEUGUNG IN DER GASKOKEREI BERLIN-MARIENDORF. (CRACKING OF OIL FOR THE PRODUCTION OF PEAK GAS IN THE COKE PLANT OF BERLIN-MARIENDORF), *Erdoel u Kohle* (German), 9, 90-93 (1956) February.

Cracking of oil for the production of gas in the coke-plant of Berlin-Mariendorf is described in detail. The procedure of cracking has been adopted from Demag AG, and has been built by the same company, January, 1956. The operation of the plant, a diagram of the cracking unit, and the raw materials are described. The economy of the procedure in production of gas for city use, and the byproducts obtained are outlined. G. Kunst

Cutler, W. J. TOWN GAS AND BY-PRODUCTS FROM THERMAL CRACKING OF 39, 62 (1956) April 13; *Gas World* (British) 143, 522-4 (1956) March 3.

A description is given of American high-Btu oil gas production, specifically from the Semet-Solvay unit. A scheme for town gas production is presented: thermal cracking to 1100-1200 Btu/SCF gas followed by catalytic reforming of a portion of the gas to adjust gas quality to town gas requirements. Byproduct credits are discussed. E. B. Shultz

THERMAL CRACKING OF HEAVY OILS. *Gas J.* (British) 286, 65, 68 (1956) April 4.

A method by which oil gas obtained by thermal cracking could be adapted by proportionate reforming for town purposes is outlined. The thermal cracking plant and the reforming process described had each been separately proved in practice, but so far as the author knew they had not yet been combined in this way for the purpose. In the conclusion of this

presentation of the paper the author said: "Leaving out the question of ethylene there is probably little to choose between thermal cracking followed by reforming, and straight forward catalytic cracking; the latter may possibly produce the cheaper therm but the former gives a gas practically free from organic sulfur and leaves a door open for the extraction of further by-products at a later date if required. The combination of thermal cracking and reforming also has advantages in countries where natural gas is available or likely to become so, as in these conditions either oil gas or natural gas can be reformed according to circumstances.

H. A. Dirksen

Stream Pollution

Lord, J. K. THE C. A. L. PLANT AND EFFLUENT DISPOSAL SYSTEM AT STOCKPORT. *Gas World* (British) **143**, 790-96, April 7; 851- 854 (1956) April 14.

A long-standing problem of stream pollution by spent gas liquor of Stockport (Manchester) was settled by cooperative studies by the Gas Board, Rivers Board, Ministry of Housing, and Stockport Corp. These studies indicated the rate of spent liquor flow which could be tolerated by the Corporation Sewage works, and established the design of a new liquor concentration plant, to handle 1000 gal/hour of crude (1.35% free NH_3) liquor. The details of this plant, storage system, and the special flow-control instrumentation are described. Free NH_3, oxygen absorbed, tar content, and temperature of spent liquor are controlled, and flow meters are used to determine payments to sewage works (4 s/gal) for the treatment. Preliminary operation indicated that a small profit will be made.

O. P. Brysch

Synthesis Gas

Janeway, P. W., Jr. (assigned to The United Gas Improvement Co.) METHOD FOR MAKING GAS RICH IN HYDROGEN. U. S. 2,743,171 (1956) April 24.

A cyclic process for synthesis gas manufacture by steam reforming of hydrocarbons is described. The author claims the elimination of thermal cracking of the reactant before it contacts the reforming catalyst by first passing the hydrocarbon through beds of hot refractory material.

E. B. Shultz

5. NATURAL GAS AND NATURAL GAS CONDENSATES

Automatic Sampling

Berglund, J. H. CONTINUOUS AUTOMATIC SAMPLING-4: CARE AND HANDLING OF SAMPLES. *Oil Gas J.*, **54**, 210-12 (1956) April 30.

This paper covers the treatment of the sample from the time it is drawn from the pipeline, storage tank, or unit until it is delivered to the laboratory for test. Precautions or procedures for withdrawing test portions from the sample container are not covered. These, where special handling is required, are outlined in the applicable A.S.T.M. test method. Author's Abstract

Johnson, R. P. CONTINUOUS AUTOMATIC SAMPLING-3: DON'T SELL SAMPLING SHORT. *Oil Gas J.*, **54**, 119-21 (1956) April 23.

Purpose of the articles in this series is to point out that the use of automatic sampling devices may provide the means for obtaining truly representative samples, thus eliminating inaccuracies existing in those obtained manually. If these results are gained, potential errors due to the human element involved in present manual procedures will be removed.

Author's Abstract

Cements

Weir, C. E., Hunt, C. M., and Blaine, R. L. BEHAVIOR OF CEMENTS AND RELATED MATERIALS UNDER HYDROSTATIC PRESSURES UP TO 10,000 ATMOSPHERES. *J. Res. Nat. Bur. Standards*, **56**, 39-50 (1956) January.

Compression studies were made, at pressures up to 10,000 atmospheres, on portland and aluminous cements, wet silica gel, hydrated tricalcium silicate, and dry and wet calcium hydroxide. The effects of composition, age, moisture content, and water-cement ratios were studied.

B. E. Eakin

Compression

Baird, R. C. CONTROL OF COMPRESSOR ROOM NOISE. *Gas Age*, **117**, 29-33 (1956) April 19.

A report of the methods used by a Southern

California Gas Company's Playa del Rey compressor station to reduce station noise. The compressor building is of brick construction, nearly all yard piping is located in pipe trenches, and a wall separates the plant from a residential area. Various other details of construction are given. R. F. Bukacek

Conditioning

Kohl, A. L. and Riesenfeld, F. C., CONDITIONING GAS FOR TRANSMISSION, *Pipe Line Ind.*, **4**, 33-37 (1956) April.

The methods for removal of particulate matter and purification of natural gas prior to transmission are reviewed, and recent advances in these fields discussed. Chemical losses and the corrosion problems encountered in amine gas treating plants are outlined, as well as methods of combatting each. Methods of reducing steam consumption are also presented.

B. E. Eakin

Drilling

Lowe, J. S. 4 WAYS TO REDUCE DRILLING TIME. *Oil Gas J.*, **54**, 98-101 (1956) March 26.

Drilling time has been reduced considerably in Texas' Big Mineral Field. Application of a combined technique, using increased hole-deflection tolerances, 8¾ inch jet bits, and oversized drill collars, resulted in a 45% reduction over standard practices. The techniques are described in detail. B. E. Eakin

Morrisey, N. H. DEEP SOUTH READY FOR DEEP PAYOFF. *Oil Gas J.*, **54**, 156, 159, 161, 163 (1956) April 30.

Recent discoveries in the Lower Cretaceous rocks of Mississippi and Alabama have increased exploration drilling in this area. The geology of the area and the typical pay zones are discussed. B. E. Eakin

O'Connor, J., DRESSER INDUSTRIES TURBODRILL DESCRIBED, *Drilling*, **17**, 71, 163 (1956) April.

Simplicity of design and the use of rubber in the thrust bearings are the outstanding merits of the Russian turbodrill. Background, history, and description of the turbodrill are presented.

B. E. Eakin

Torell, L. C. WHAT'S WRONG WITH TAPERED DRILLING LINES? *World Oil*, **142**, 232, 237 (1956) April.

Stepped or "tapered" drilling lines for percussion tools have many advantages over standard wire lines. Some of the construction difficulties are also outlined. B. E. Eakin

Wallis, W., FRANCE REPORTS SUCCESS WITH ITS TURBINE PROCESS, *Drilling*, **17**, 80-82 (1956) April.

An experimental turbine operated in France has drilled through hard limestone at a rate of 91 feet per hour, approximately 10 times as fast as the French rotary equipment. Economic studies indicate that the turbodrill must drill at least 2.3 times as fast as a rotary to be profitable. B. E. Eakin

SPECIALIZED DRILLING ENGINEERS PAY. *Petroleum Week*, **2**, 15-16 (1956) April 27.

A brief description of the "drilling engineering" section developed by Magnolia Petroleum Co. as an answer to the problem of high drilling costs. By separating the drilling and producing functions it is hoped that drilling problems will receive more attention. R. F. Bukacek

Exploration

Brannon, H. R., Jr. and Osoba, J. S. SPECIAL GAMMA-RAY LOGGING. T. P. 4208. *J. Petroleum Techn.*, **8**, 30-35 (1956) February.

Use of the scintillation counter for well logging permits determination of the natural radioactivity of sediments. The relative amounts of the elements in the sediment that are emitting gamma radiation can be determined. The new method, called "spectral logging," appears to be a bright new tool for obtaining geological information. B. E. Eakin

Bray, E. E. (assigned to Socony Mobil Oil Co.) GEOCHEMICAL EXPLORATION METHOD. U. S. 2,742,575 (1956) April 17.

This invention relates to an improved geochemical exploration technique based on analyzing earth samples by use of infrared radiation. The presence of petroleum hydrocarbons in the earth samples cause a characteristic set of minimums to occur in the radiation curve obtained for the extract. B. E. Eakin

Linn, E. H. SEDIMENTATION: KEY TO APPALACHIAN PRODUCTION. *Oil Gas J.*, **54**, 165-68, 170, 173 (1956) April 30.
Geological evidence indicates possible new oil and gas production will be discovered in the deeper formations of the Appalachian basin. This author has attempted to show a regional area that should have received favorable sedimentation and geologic history for the formation of reservoirs and traps. B. E. Eakin

Lundberg, H. LOW RADIATION INTENSITIES OVER OIL FIELDS. *Oil Gas J.*, **54**, 192-93, 195 (1956) April 30.
The behavior of surface radioactivity over favorable formations in the presence and absence of petroleum accumulation is outlined.
B. E. Eakin

Salter, R. E. MAGNETIC TAPE RECORDER SPELLS PROGRESS. *World Oil*, **142**, 142-44, 146 (1956) April.
The use of magnetic recording techniques for seismic prospecting has made enormous advances in the last few years. Magnetically recorded data is also much easier to analyse mechanically (electronically), and several highly complex playback and analysis machines are being developed. The early history of magnetic recording is also presented. B. E. Eakin

RIG REACHES PAKISTAN. *Oil Gas J.*, **54**, 94 (1956) April 23.
West Pakistan will have two deep-drilling rigs operated by American companies exploring within the next 2 months. Promising geologic features forecast considerable activity in the near future. B. E. Eakin

Geophysical Techniques

McCarver, H. C. GEOPHYSICS IS HERE TO STAY. *Oil Gas J.*, **54**, 110-12 (1956) April 30.
The increase in variety and ability of available techniques in geophysical exploration has also resulted in an increase in cost. However, better integration of effort between the geologist and geophysicist, and greater care in choosing men for responsible positions, should improve this situation. B. E. Eakin

FINDING OIL WITH GEOPHYSICS. *Oil Gas J.*, **54**, 123A-134L (1956) April 30.
The principal targets and seismic features of the Rocky Mountain, Mid-Continent, Gulf-Coast, West Texas, and Canadian areas are outlined pictorially. A check list for successful exploration is presented. B. E. Eakin

LP-Gas Mixing

Drake, F. E. (assigned to Harry W. Townsend, New Rochelle, N. Y.) APPARATUS FOR MIXING AIR AND LIQUIFIED PETROLEUM GASES. U. S. 2,738,261 (1956) March 13.

This invention claims an improved apparatus for mixing air with gas from vaporized LPG, and a highly accurate technique for control of the heating value of the mixture.
B. E. Eakin

Production

Moore, T. V. PRODUCTION TECHNOLOGY AND RECOVERABLE OIL RESERVES. *Cal. Oil World*, **49**, 2nd issue, 1-2, 6, 8-9 (1956) March.

This paper discusses the effect of technological developments on the recoverable petroleum reserves, and offers some opinion as to how new processes, presently being developed in the laboratory, might effect future reserves.
B. E. Eakin

Reservoir Engineering

Brownell, L. E., D. C. Gami, R. A. Miller, W. F. Nekarvis, PRESSURE DROP THROUGH POROUS MEDIA, Part V, *Amer. Inst. Chem. Eng. J.*, **2**, 79-81 (1956) March.

Fluid flow data are presented for beds of uniformly sized spheres consolidated with resin over a porosity range from 36.4 to 12.3%. The data are analyzed in terms of an effective pore volume, and equations are given for predicting pressure-drop by use of a friction-factor vs Reynolds-number plot. B. E. Eakin

Higgins, R. V. CALCULATING OIL RECOVERIES FOR SOLUTION-GAS-DRIVE RESSERVOIRS. U. S. Bur. Mines Rep. Invest. 5226 (1956) April.

Applications of the Tarner and Muskat methods of predicting reservoir performance are presented, and detailed results of many stepwise calculations are shown by means of tables. Oil recoveries by the Tarner method are not highly sensitive to small errors in choice or determina-

tion of such reservoir-rock properties as k_g/k_o saturation relationships or reservoir fluid properties. Specific examples and details are presented in this report to guide reservoir engineers in approximating the influence of the various factors in recovery. B. E. Eakin

Von Rosenberg, D. U., MECHANICS OF STEADY STATE SINGLE-PHASE DISPLACEMENT FROM POROUS MEDIA, *Amer. Inst. Chem. Eng. J.*, 2, 55-58 (1956) March.

The physical process of displacement of a fluid from a packed sand tube by another fluid of the same density and viscosity during steady state viscous flow has been studied experimentally and mathematically. The length of the zone of mixing which comprises the displacement front is predicted to be dependent upon pore geometry, the two-fluid system diffusion coefficient, the rate of flow, and the distance the front has traversed at the time of its observation. Effect of flow rate and distance which front has traversed were studied, and are reported. B. E. Eakin

Wilson, J. W., DETERMINATION OF RELATIVE PERMEABILITY UNDER SIMULATED RESERVOIR CONDITIONS, *Amer. Inst. Chem. Eng. J.*, 2, 94-100 (1956) March.

Complete water-oil relative-permeability data were obtained on four natural-sandstone cores. Kerosene and salt water were used at fluid pressures to 5000 psi and overburden pressures to 10,000 psi. Results obtained indicate that low pressure relative permeability data was essentially the same as at 5000 psi, and that overburden pressure affected the relative permeability about in the same proportion as it affects the single-phase permeability.

B. E. Eakin

Underground Storage

Evans, R. E. and Thompson, J. E. VENT GAS PROBLEM IS SOLVED BY NATURAL GAS STORAGE COMPANY. *Pipe Line News*, 28, 46-46 (1956) April.

A description of the vent gas system built by the Natural Gas Storage Co. to control the leakage of gas from the Herscher Storage field. The system comprises vent-gas gathering wells and piping, gas purification equipment, three-stage compression of gas and injection back into the storage formation. R. F. Bukacek

Kinney, G. T. UNDERGROUND GAS STORAGE STILL RISING. *Oil Gas J.*, 54, 68-71 (1956) April 23.

A summary of statistics on underground gas storage. A tabulation showing the companies involved, storage location, and storage capacities is given with a brief discussion of the advantages of underground storage.

R. F. Bukacek

Well Practise

Craig, F. F., Jr. and Geffen, T. M. THE DETERMINATION OF PARTIAL PRESSURE MAINTENANCE PERFORMANCE BY LABORATORY FLOW TESTS T. P. 4207. *J. Petroleum Techn.*, 8, 42-49 (1956) February.

A mathematical technique has been developed to predict the saturation and pressure gradient behavior of dispersed gas-drive partial-pressure maintenance reservoirs. The calculated results for a given set of conditions were compared with data obtained from a set of laboratory model flow tests, with good agreement. Results indicate maximum oil recovery by gas injection programs is obtained by full pressure maintenance at the original reservoir fluid bubble-point. B. E. Eakin

Johnston, W. R. GAS WELLS FRACTURED WITHOUT SAND. *Petroleum Week* 2, 17 (1956) April 27.

A digest of remarks made to members of the API production division meeting in Denver. Completion method trends in the San Juan Basin are described. R. F. Bukacek

McGhee, E. REFRIGERATION STOPS TROUBLE ON GAS-LIFT SYSTEM. Oil Gas J., 54, 104, 107 (1956) April 9.

The use of a mechanical refrigeration unit on the gas-lift wells of Southern Minerals Co. in the Falls City field in Texas has stopped hydrate troubles and increased hydrocarbon recovery. The increased recovery is sufficient to make the unit pay out in a very short time.

B. E. Eakin

6. PETROLEUM AND SYNTHETIC LIQUID FUELS

Cat Cracking

Nicholson, E. W. and Sweetser, S. B. (assigned to Esso Research and Eng. Co.) CRACKING OF REDUCED CRUDE WITH THE USE OF INERT AND CATALYST PARTICLES. U. S. 2,742,403 (1956) April 17.

This scheme for heavy oil cracking involves two stages of fluidized operation. The first employs inert solids and is a coking pretreatment step. The second is a fluidized bed consisting of coarse inert particles and fine cracking catalyst particles. Due to the difference in fluidization properties, the catalyst will rise to the top. Feed is thus maintained at cracking conditions first with inerts, then with catalyst. Improved catalyst regeneration characteristics are claimed.

E. B. Shultz

Fuel Oxidation

Ming, E. T. and Bott, L. L. METALS AFFECT DISTILLATE STABILITY. *Petroleum Refiner*, 35, 192-94 (1956) April.

The effect of metals on oxygen uptake of distillate fuels was studied. To measure the effects, a new method, similar to the Warburg manometric method used in biochemical studies, was developed.

D. M. Mason

Fluid Coker

Maass, R. H. and Newchurch, E. J. FLUID COKER: MECHANICAL DESIGN ASPECTS. *Petroleum Eng.*, 28, C36, 38, 41 (1956) April.

This is a condensation of a paper given before the ASME at New Orleans in September 1955. The apparatus described is quite similar to a fluid catalytic cracking unit. Details of feed and steam injection, entrained coke separation, temperature and pressure control, refractory linings are briefly described.

E. B. Shultz

Hydrodesulfurization

Heinemann, H. HYDROGENATIVE PROCESSING AND DESULFURIZATION PATENTS. *World Petroleum*, 27, 66, 67, 83 (1956) April.

This subject was last reviewed in the 1955 Annual Refinery Review issue of World Petroleum. Its continued importance to the petroleum industry is evident from the predictions of expansion of reforming capacity and the constantly increasing use of relatively high sulfur content crudes. The flow of new patents in this field has been quite constant over the past two years, but the wide interest in the subject and the large volume of research and development work done on it are shown in the broadening of assignees of patents. Many companies are now obtaining patents in this field for the first time. The current digest covers the U. S. patent literature through January 1956.

Author's Abstract

McAfee, J. and Horne, W. A. HYDROGEN TREATING. *Petroleum Processing*, 11, 47-52 (1956) April.

Typical results from hydrogen upgrading of whole crudes, residual fractions and intermediate distillates are shown. Usual operating conditions are 500-800° F., 100-1000 psig, 0.5-20.0 CF oil/CF catalyst/hr, and 400-4000 SCF hydrogen/bbl oil recycle gas rate. Diesel and heating oils are currently being treated to reduce sulfur content and carbon residue and improve color stability. Catalytic cracking charge stocks are being treated to effect these same improvements plus boiling range reduction. Crudes and residuals are converted to lower boiling distillate products in the Gulf HDS process (see Petroleum Refiner, June 1956, pp. For instance, Kuwait reduced crude with 5.8 API gravity and 19.8% carbon residue was converted to 33 API gravity, 1.1% carbon residue product with 1140 SCF/bbl hydrogen consumption.

E. B. Shultz

Illinois Oil Shale

Lamar, J. E., Armon, W. J. and Simon, J. A. ILLINOIS OIL SHALES. Illinois State Geol. Survey Urbana, Ill., Circ. 208 (1956).

Illinois shales and oil-bearing limestones were tested by modified Fischer retort assay to determine oil content. Pennsylvanian shale samples ranged from 0 to 40 gallons per ton, but only three samples contained more than 25 gallons per ton. Shale above the Number Two coal bed in northern and western Illinois had the highest average oil content, about 16 gallons per ton. After studying 114 samples from 41 counties, the authors conclude that these shales are of future significance rather than of immediate commercial importance.

E. B. Shultz

Lubricant Additives

Boner, C. J. ADDITION AGENTS FOR LUBRICANTS—PART I. *Petroleum Eng.*, 28, C53-56, 58, 60, 64, 65 (1956) March.
A brief summary covering the field of the additives added to lubricants. Patents, functions, effects, types and some of the additives themselves are briefly covered. R. R. Amrine

Oil Exploration

Leversen, A. I. BETTER EXPLORATION PROMISES ENOUGH AMERICAN OIL FOR U. S. *World Oil*, 142, 80-87 (1956) April.
It is estimated that the country's oil requirements will double in the next 25 years. The required supplies can be developed domestically if new ideas and improved techniques are fully utilized. Better recovery methods is the fastest way to improve supplies. B. E. Eakin

Production

Wilson, C. O. NEW OUTLETS A MUST FOR CANADA. *Oil Gas J.*, 54, 64-66 (1956) April 9.
Production from Canada's new and existing oil fields is fast outstripping domestic demand. Pipeline expansion to replace present Canadian import with domestic crude, and increased exports are believed to be the best solution.
B. E. Eakin

Petroleum Transportation

Hills, A. T. ROAD TRANSPORT IN THE OIL INDUSTRY. *Petroleum* (British), 19, 85-90 (1956) March.
The use of road transports in the British oil industry and the changing overall distribution pattern are reviewed. B. E. Eakin

ROAD TANKERS—SOME DESIGN FACTORS. *Petroleum* (British), 19, 91-95 (1956) March.
A survey is presented of the progress that has been made in the design and construction of bulk transports for petroleum derivatives. The work of one of the major British manufacturers of road tanker vehicles is used as illustration.
B. E. Eakin

SUPER-COLOSSAL TANKERS COMING. *Petroleum Week*, 2, 35-36 (1956) April 13.
Tankers are already under construction that have a capacity of 83,000 tons each, and both shippers and builders are predicting even larger vessels. Principal difficulties are lack of berthing and service facilities. B. E. Eakin

Thermal Drive

Elkins, L. E. (assigned to Stanolind Oil and Gas Co.) PRODUCTION FROM BITUMINOUS SANDS. U. S. 2,734,579 (1956) February 14.
A thermal method is described for the recovery of oil from tar sands, such as the Athabaska tar sand. Principal claim is to a method of measuring and controlling the effective temperature in the zone. B. E. Eakin

Garbus, R. HOT GAS-STEAM RECOVERY METHOD TESTED IN ILLINOIS FIELD. *World Petroleum*, 27, 64-65 (1956) April.
A new thermal secondary recovery method has been tested in the Parker pool in Illinois. Oxygen injected with a hot gas-steam mixture induces spontaneous combustion in oil sands. Tests indicated recovery of up to 80% of oil in place, with the volume burned in-situ estimated at about 10%. B. E. Eakin

Walter, H. (assigned to Worthington Corp.) METHOD AND APPARATUS FOR OIL RECOVERY. U. S. 2,734,578 (1956) February 14.
This invention relates to a method and apparatus for increasing the recovery of oil from producing formations. It provides for the injection of a mixture of super-heated steam and combustion gases into the oil-bearing formation, and is essentially a thermal technique for increasing recovery. B. E. Eakin

7. ANALYTICAL METHODS AND TESTS

Amine Reagents

Critchfield, F. E. and Johnson, J. B. COLORIMETRIC DETERMINATION OF PRIMARY ALIPHATIC AMINES BY COPPER-SALICYLALDEHYDE METHOD. *Anal. Chem.*, 28, 436-40 (1956) April.
A new method for the determination of primary aliphatic amines in the presence of secondary and tertiary amines is described. The primary amine is made to react with an aqueous reagent containing cupric chloride, salicylaldehyde, and triethanolamine. The copper-salicylaldehyde-

imine formed in this reaction is extracted into 1-hexanol. The amount of copper in the hexanol layer, which is determined colorimetrically by reaction with bis (2-hydroxyethyl) dithiocarbamic acid, is a measure of primary amine in the sample. The method has been successfully applied to 15 amines. Data for the analysis of several amine mixtures are given. In most cases an accuracy within 5% can be expected. Interfering compounds and those which fail to react are discussed. D. M. Mason

Carbonyl Sulfide

O'Hara, F. J., Keely, W. M., and Fleming, H. W. SPECTROPHOTOMETRIC DETERMINATION OF CARBONYL SULFIDE IN PETROLEUM REFINERY GASES. *Anal. Chem.*, 28, Part I, 466-70 (1956) April.

A spectrophotometric method for the determination of carbonyl sulfide in petroleum refinery gases is based on the reaction of carbonyl sulfide with piperidine in aqueous solution to form piperidine oxythiocarbamate. This analysis is performed without any interference from hydrogen, oxygen, nitrogen, carbon monoxide, methane, ethane, acetylene, ethylene, propane, and propylene; and techniques are presented for either removing or correcting interferences that result from the presence of hydrogen sulfide, methyl mercaptan, carbon dioxide, sulfur dioxide, carbon disulfide, thiophene, and conjugated diolefins. An accuracy of 1 p.p.m. of carbonyl sulfide can be obtained for synthetic blends within the range of 1 to 50 p.p.m. The results on refinery samples are reliable to within 10% of the amount present in the range from 1 to 50 p.p.m. of carbonyl sulfide.

Authors' Abstract

Chromatography

James, A. T. THE GAS-LIQUID CHROMATOGRAM. *Endeavour* (British) 15, 73-78 (1956) April.

A discussion of gas-liquid chromatography and its applications is presented. Automatic titration is used as a detection device for the example given. D. V. Kniebes

Electron Microscopy

Swerdlow, M., Dalton, A. J. and Birks, L. S. ELECTRON MICROSCOPY. *Anal. Chem.*, 28, 597-609 Part II (1956) April.

A brief summary of the literature on electron microscopy covering the year 1955. There are 264 references listed. R. R. Amrine

Hydrocarbons by Charcoal

Crawford, H. R. TAKE ANOTHER LOOK AT THE CHARCOAL WEIGHT TEST. *Petroleum Refiner*, 35, 166-69 (1956) April.

Recent work on refinement of the charcoal weight test for determining heavy hydrocarbons in natural gas is described. Reported advantages of the use are accuracy of results, a realistic form of reporting results, short testing time, suitability for field testing, and simple low cost equipment. D. M. Mason

Etherington, L. D., Haney, R. E. D., Herbst, W. A., and Scheeline, H. W., ADSORPTION PHASE EQUILIBRIUM CORRELATIONS: LIGHT-HYDROCARBON VAPORS ON ACTIVATED CHARCOAL, *Amer. Inst. Chem. Eng. J.*, 2, 65-70 (1956) March.

Data correlations are presented for calculating equilibrium adsorption of pure hydrocarbon vapors and their mixtures, composed of C_1 to C_4 hydrocarbons, on gas-adsorbant grades of activated charcoal. Approximate adsorptive heats, a limited amount of high-temperature steam adsorption data, and sample calculations on application of the correlations are included.

B. E. Eakin

Hydrocarbons by Extraction

Eckerson, B. A. and Walters, C. J. DO YOU TEST HEAVY HYDROCARBONS IN GAS? *Petroleum Refiner*, 35, 160-62 (1956) April.

A new, accurate method for determining heavy hydrocarbons in natural gas is presented here. It is based on counter-current contacting of the sample gas with liquid propane. Pentanes and heavier fractions are totally extracted in quantities large enough for subsequent tests such as true boiling distillation, molecular weight, and gravity. D. M. Mason

Infrared Review

Gore, R. C. INFRARED SPECTROSCOPY. *Anal. Chem.*, 28, 577-91 (1956) April.

This article contains a brief review of the fun-

damental developments in analysis in infrared spectroscopy for the past two years. Thirty-seven references are given. E. Mann

LP-Gases

Hammerich, T., Moeller, H. and Sasse, E. BEURTEILUNG UND UNTERSUCHUNG VON FLUESSIG-GASEN NACH DEM DER-ZEITIGEN STAND DER NORMUNG. (PRESENT STATUS OF THE EXAMINATION AND EVALUATION OF LIQUEFIED GASES. *Erdoel und Kohle* (German) **9**, 98-102 (1956) February.

Standard specifications and tests used in Germany for liquefied fuel gases are reviewed. Results from a simplified distillation apparatus (the Hammerich), which is used for routine analysis, are compared with those from the Podbielniak column. Other methods described are: "TND" distillation, a qualitative test for H_2S, determination of elemental S, COS, total S, NH_3, oil and gum, to vapor pressure. COS content was found to be important because of its tendency to hydrolyze to H_2S in the presence of water and iron or steel surfaces.

D. M. Mason

Lube Oil Trace Elements

Fry, D. L. THE SPECTROGRAPHIC ANALYSIS OF LUBRICATING OILS. *Appl. Spectroscopy*, **10**, No. 2, 65-68 (1956).

Brief general discussion of results obtained by General Motors obtained in attempting to improve the rotating disk method of trace analysis of lubricating oils. A comparison of the speed, accuracy, and repeatability with other spectroscopic methods they have used is presented.

R. R. Amrine

Mass Spectrometry Survey

Dibeler, V. H. MASS SPECTROMETRY. *Anal. Chem.*, 28, Part II, 610-15 (1956) April.

A review is presented with selected references representative of the diverse applications of mass spectrometry, covering the previous year 1955 through November. Additional surveys cover particular applications but the field has so expanded and increased that space limits the complete coverage. 284 references are listed.

J. E. Neuzil

Resonance Spectroscopy

Brown, J. K. NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY. *Brit. Coal Utilizn. Res. Assoc. Monthly Bull.*, **20**, 105-18 (1956) March.

A brief account of the simple theory and apparatus associated with nuclear magnetic resonance spectroscopy. The technique in the study of molecular structure in solids and liquids is illustrated by simple examples from published work and reference is made to others which show the scope of the method. J. E. Neuzil

Sulfur Method

Bogan, E. J. and Moyer, H. V. EFFECT OF AGING SOLUTIONS OF BARIUM CHLORIDE ON PARTICLE SIZE OF BARIUM SULFATE. *Anal. Chem.*, 28, 473-76 (1956) April.

The aging of barium chloride solutions which were used to precipitate barium sulfate was found to cause an increase in the particle size of the precipitate. Filtration of a freshly prepared solution of barium chloride through a fine sintered-glass or porcelain filtering crucible produced the same effect as aging. The particle size of the precipitate seems to be a function of the number of nuclei which are available as starting points for crystallization. The origin of the nuclei was not established with certainty, but considerable evidence supports the theory that aggregates of incompletely dissolved barium chloride in the fresh solutions may serve as nuclei for starting crystals of barium sulfate.

Authors' Abstract

Jackson, P. J. DETERMINATION OF TOTAL SULPHUR IN COAL: AN INTERNATIONAL STANDARD METHOD. *Fuel* (British) **35**, 212-29 (1956) April.

A comprehensive study of the Eschka method for determining the total sulphur content of solid mineral fuels has been made by a Working Group of Technical Committee 27 of the International Organization for Standardization. Investigations leading to the preparation of a Draft Recommendation for an internationally acceptable method are described. Features of the procedures currently used in different national Standards have been shown to be equivalent, and are recommended as alternatives.

Members of the Group have suggested simple techniques which allow the application of the method to fuels of high sulphur and high volatile matter content, and to those containing abnormally large proportions of barium. The recommended procedures have been proved experimentally using a wide range of samples.
Author's Abstract

X-Ray Techniques

Post, B. and Fankuchen, I. X-RAY DIFFRACTION. *Anal. Chem.*, 28, Part II, 591-95 (1956) April.
Review of X-ray diffraction work which was published during 1955. The discussion has been limited to items believed to be of interest to chemists, and 78 references are listed.
R. R. Amrine

Regler, F. THE "SWEEPING-BEAM" METHOD OF X-RAY ANALYSIS. *Engineers Dig.*, 17, 101-07 (1956) March.
Synchronous rotation of the film and sample with their parallel axes placed eccentrically to each other increases the number of crystals investigated without changing the interference patterns caused by the relative crystal orientation.
R. R. Amrine

8. GENERAL AND PHYSICAL CHEMISTRY

Adsorption

Parks, A. S. and Dow, W. M. NEW WELL-HEAD ADSORPTION UNIT AND WHAT IT MEANS. *World Oil*, 142, 286, 89, 92, 94, 96, 301-04 (1956) April.
Extensive laboratory research and field testing have resulted in the development of a new, small, short-cycle, dry-desiccant adsorption unit for gas well-head applications. The unit recovers 2 to 4 additional barrels of liquid hydrocarbons per MMCF as well as dehydrating the gas. No external source of energy nor cooling water is required.
B. E. Eakin

Catalyst Review

Boudart, M. and Kwan, T. HETEROGENEOUS CATALYSTS. *Ind. Eng. Chem.*, 48, 562-69, Part II (1956) March.
This annual review of the field covers 121 references from early 1954 to mid 1955, and represents a selection by the authors of the best in fundamental catalytic research. Topics included are: catalyst structure, adsorption, surface reaction, and diffusion to catalytic sites. Given particular attention is a new kinetic method permitting determination of the slow step in a reaction sequence by rate measurements near and at equilibrium.
E. B. Shultz

Deutero-ethylene

Varnerin, R. E. and Dooling, J. S. THE MECHANISM OF THE HOMOGENEOUS THERMAL REACTION BETWEEN ETHYLENE AND DEUTERIUM. *J. Amer. Chem. Soc.*, 78, 1119-29 (1956) March 20.
The reaction $C_2H_4 + D_2$ has been studied and the initial rates of formation of the products have been measured at a series of temperatures. Initially $CH_2 = CHD$ is formed predominantly accompanied by smaller quantities of HD and C_2H_5D and still smaller quantities of C_2H_6, $C2H_4D_2$ and H_2. The results are interpreted in the basis of a free radical mechanism.
Authors' Abstract

Hydrogenation Catalysts

Smith, B. D. and White, R. R. CATALYTIC HYDROGENATION OF CARBON MONOXIDE AND DIOXIDE OVER STEEL. *Amer. Inst. Chem. Eng. J.*, 2, 46-54 (1956) March.
Catalytic hydrogenation of carbon monoxide and dioxide over various steel catalysts was studied in a temperature range of 800° - 1300° F. and pressures of 5 to 30 atm. The experimental equipment and the analytical methods used are described in detail. Some of the steels used are mentioned and a brief discussion of the pretreatments of the catalysts are given. The feed gases (3.75 to 20 SCFH) were passed over a catalyst bed of ⅛" steel balls in a brass-lined reactor. The percentage of carbon oxides in the feed was 30% in the runs using a H_2-CO_2 feed. The effects of temperature, pressure, feed composition, space and mass velocity was studied and the removal of carbon from catalyst by oxidation with air was considered. It was found that deposition of carbon did not affect the activity of the catalyst and could be removed easily.
G. Kunst

Ion Exchange

Morries, P. and Stuckey, R. E. LABORATORY APPLICATIONS OF ION EXCHANGE RESINS.—PART II: SOME APPLICATIONS TO

ORGANIC AND INORGANIC CHEMICAL INVESTIGATION. *Lab. Practice*, 5, 129-33 (1956) April.

Applications discussed here include: separation of aldehydes, ketones, sugars, alkaloids, and organic acids; separation and concentration of trace constituents, such as hardness in water and copper in milk; removal of interfering materials; fractionation of rare earths; use of ion-exchange resins as membranes for selective dialysis of cations or anions. D. M. Mason

Flash Point Prediction

Butler, R. M., Cooke, G. M., Lukk, G. G., and Jameson, B. G. PREDICTION OF FLASH POINTS OF MIDDLE DISTILLATES. *Ind. Eng. Chem.*, 48, 808-12 (1956) April.

An equation for flash temperature as a function of mole fraction, molecular weight and latent heat of evaporation is developed and applied to typical naphtha and gas-oil mixtures. Another method for predicting flash point from distillation curves is demonstrated in example problems. E. B. Shultz

Radioisotope Techniques

Meyer, A. W. INSTALLING A SMALL HOT ATOMIC LAB? *Ind. Lab.*, 7, 62-64 (1956) May.

The costs of installing and operating small size radiation and radioisotope laboratories are discussed. Available types of radiation sources are listed with the estimated costs of purchase and installation. D. V. Kniebes

Schrodt, A. G. and Libby, W. F. HOT ATOM CHEMISTRY OF CARBON: PARTICULARLY IN AROMATIC SYSTEMS. *J. Amer. Chem. Soc.*, 78; 1267-73 (1956) April 5.

The reactions of radioactive C^{14} carbon atoms moving with high velocities (up to 40,000 electron volts) have been studied in aniline, methanol, triphenylamine, aniline hydrofluoride, ethylamine and methylamine hydrofluoride at room temperature. The hot C^{14} atoms were generated by reaction of thermal neutrons with nitrogen 14, N^{14} (n, p) C^{14}. It was demonstrated that the nature of the carbon hot atom reactions is independent of the choice of nitrogenous solute and therefore characteristic of the solvent hydrocarbon. A variety of products was produced ranging from light gases to heavy molecules, with a tendency to yield heavy materials in the case of aromatic compounds. The experimental results of the compounds mentioned are discussed and they support in a general way the hot atom theory developed previously by Rowland: J. Chem. Phys., 21, 1940 (1953). G. Kunst

Water Adsorbants

Walker, W. O. and Hostettler, J. B. A STUDY OF THE WATER SORPTION CHARACTERISTICS OF SILICA GEL, ACTIVATED ALUMINA, ANHYDROUS CALCIUM SULFATE. *Refrigerating Eng.*, 64, 34-38, 90 (1956) April.

Reactivation to the original zero-adsorption point was found for silica gel either at atmospheric or sub-atmospheric pressures. The zero-adsorption point was less reproducible for calcium sulfate and not reproducible for activated alumina. Vacuum activation as opposed to atmospheric did not significantly affect reproducibility. J. F. Reed

9. ORGANIC CHEMISTRY

Canadian Expansion

Hutchison, A. W. and Stevens, R. G. THE CANADIAN PETROCHEMICAL INDUSTRY: A RAPID EXPANSION. *Can. Chem. Processing*, 40, 38-40, 42, 44, 49-51 (1956) April.

The span of petrochemical developments in Canada covers little more than a decade. The lapse of twenty years from the time of inception of the industry to Canada's entry into the manufacture of petrochemicals was the result of formidable deterrents, including the large area of the country, the small population, inadequate domestic markets and an insufficiency of hydrocarbon raw materials. This era ended some twelve years ago with Canada's first manufacturing venture in that field. The development of this new industry was rapid, and multiple plants are now located at Edmonton, Calgary, Sarnia and Montreal. Capital investment has reached approximately $235 million. The average growth since 1954 has been at the rate of 18 per cent per year. Some fifty petrochemicals are now being produced commercially by about fifteen companies. Authors' Abstract

Fuel Chemicals

Padovani, C. LO SVILUPPO DELLA VALORIZAZIONE CHIMICA DEI COMBUSTIBILI

IN ITALIA (THE DEVELOPMENT OF THE CHEMICAL EXPLOITATION OF FUELS IN ITALY) *Rivista dei Combustibili* (Italian), **10**, 173-202 (1956) March.

The author reviews the development of the chemical exploitation of fuels in Italy throughout the period during which he was a university professor and research worker. Imported solid fuels have been decreasingly used to cover Italy's power requirements to a smaller proportion than liquid fuels and hydroelectric and geothermoelectric power. Imported coal for coke ovens and gas works has increased progressively to its present 50% of the total. Italian solid fuels are now very little used owing to price. The Italian petroleum industry has been speedily rebuilt and modernised as importance in chemical conversion of hydrocarbons is already considerable.

Author's Abstract

Nitrogen Bases

McKinnis, A. C. (assigned to Union Oil Co.) RECOVERY OF NITROGEN BASES FROM MINERAL OILS. U. S. 2,741,578 (1956) April 10.

Mineral oils are treated by selective solvent extraction to segregate nitrogen-base compounds in useful form. Neutral organic hydroxy solvents are used in quantities sufficient to extract the nitrogen bases but insufficient to extract aromatic hydrocarbons from the feed oil. Seventeen claims are made. E. B. Shultz

Oxidation Catalysts

Cambron, A. and Alexander, W. A. SKELETAL SILVER CATALYSTS FOR THE OXIDATION OF ETHYLENE TO ETHYLENE OXIDE. *Can. J. Chemistry*, **34**, 665-71 (1956) May.

Skeletal silver catalysts of high specific activity have been prepared by the removal of calcium from calcium-silver alloys. The activity of these catalysts in the oxidation of ethylene to ethylene oxide has been investigated. Catalysts prepared by the removal of the other alkaline earth metals from their alloys with silver have also been studied. It has been found that catalysts prepared from calcium-silver alloys show a higher specific activity and are more stable and more conveniently prepared than the catalysts from the other silver alloys investigated.

Authors' Abstract

Oxo-Synthesis

Bhattacharyya, S. K. and Subba Rao, B. C. STUDIES ON OXO PROCESS. *Petroleum* (British) **14**, 119-23 (1956) April.

Batch experiments on the synthesis of propionaldehyde from ethylene and synthesis gas in presence of cobalt catalysts were carried out in the vapor phase. Optimum conditions were found to be 4300 psi and 150° C. Effects of residence time, pressure, temperature, cobalt concentration, carrier types, and promoters were studied. Extensive data are given in tables and graphs. E. B. Shultz

Radiation Chemistry

McClinton, L. T., Garrison, W. M., and Burton, M. (assigned to United States of America) ORGANIC COMPOUND BOND RUPTURING PROCESS. U. S. 2,743,223 (1956) April 24.

Rupture of C-C and H-C bonds of hydrocarbons, such as cyclohexane, with formation of lower molecular hydrocarbons, hydrogen, and a high polymer are claimed by neutron bombardment of the hydrocarbon in a nuclear fission reactor. Selective rupture of bonds may be obtained by using selected narrow ranges of neutron energies, and substitution or addition of other atoms may be obtained by bombardment in presence of proper reagents. O. P. Brysch

10. CHEMICAL ENGINEERING

Absorption

Tait, J. H. MULTISTAGE GAS ABSORPTION IN THE GAS AND COKING INDUSTRIES. *Gas World* (British), **143**, Suppl. 69-76 (1956) April 7.

A brief description of multistage gas absorption practice with reference to the processing of gas produced by coal carbonization. A comparison of multistage water countercurrent absorption is given. R. F. Bukacek

Bubble Cap Trays

Bolles, W. L. OPTIMUM BUBBLE-CAP TRAY DESIGN. PART III—DESIGN TECHNIQUE. *Petroleum Processing*, **11**, 72-79 (1956) April.

This article develops design techniques by which it is possible to achieve the optimum tray design for a specific application. R. F. Bukacek

Garner, F. H. and Freshwater, D. C. PRESSURE DROP, HOLD-UP, AND EFFICIENCY OF A LARGE BUBBLE CAP PLATE. *Inst. Chem. Engrs. Trans.* (British) 33, No. 4, 280-88 (1956).

An extension of the earlier work on a large bubble-cap plate is reported and details are given of measurements of the quantity of foam on the plate. Efficiency data based on air humidification tests are presented and an attempt is made to correlate the measurements of pressure drop, foam quantity and efficiency for a 5 ft. diameter bubble-cap plate. The fluid hydraulics, cap pressure drops and fluid head on the plate have been investigated over a range of air and water flow rates. Liquid-hold up has been measured to determine the amount of foam on a plate. The significance of the pressure drop and foam quantity in relation to efficiencies are discussed. G. Kunst

Fluid Flow

Chenoweth, J. M. and Martin, M. W. PRESSURE DROP OF GAS-LIQUID MIXTURES IN HORIZONTAL PIPES. *Petroleum Eng.*, 28, C42-45 (1956) April; *Petroleum Refiner*, 34, 151-55 (1955) October; *Pipe Line Ind.*, 3, 50-52, 55, 57 (1955) November.

A correlation for pressure drop of gas-liquid mixtures in horizontal pipes is presented based on new data for 1.5- and 3-inch pipe. The correlation fits the other available data as well as can be expected, and is apparently an improvement over Lockhart and Martinelli's correlation. R. F. Bukacek

Miner, I. O. THE DALL FLOW TUBE. *Amer. Soc. Mech. Eng. Trans.*, 78, 475-79 (1956) April.

A report of a study of the Dall flow tube, a primary flow metering device which is substantially a special-type of flow nozzle. The device produces markedly higher differential than does corresponding Herschel-type venturi tubes, and also produces a notably lower head loss than the venturi. R. F. Bukacek

Weissenborn, A. (assigned to Koppers Co., Inc.) APPARATUS FOR REGULATING THE FLOW OF A GAS MIXTURE. U. S. 2,741,261 (1956) April 10.

This invention relates to an apparatus for regulating the rate of flow of a mixture of gases, the calorific value of which is regulated. A double diaphragm system is described; one diaphragm is acted upon by the pressure differential across a throttling element, the other by a counter pressure which depends upon the specific gravity of the gas mixture.

R. F. Bukacek

Hot Dust Filtration

First, M. W., Graham, J. B., Butler, G. M., Walworth, C. B., and Warren, R. P. HIGH TEMPERATURE DUST FILTRATION. *Ind. Eng. Chem.*, 48, 696-702 (1956) April.

Results are presented of tests conducted in a filter-testing apparatus in which dust-laden air at temperatures up to 1500° F. was filtered in a 6-inch square duct by means of a ceramic fiber filter *(Fiberfrax)*. Dust loadings ranged from 10 to 40 gr. of copper oxide per 1000 CF of air (70° F-1 atm.) Gas velocities ranged from 350 to 700 ft/min. The mean diameter of the filter fibers was 20 microns and filter depths ranged from 1.5 to 8 inches. Filtration efficiency was found to increase rapidly up to 4 inches of filter depth and less rapidly above this. An increase in the gas velocity also produced a decline in the filtration efficiencies. To obtain a removal efficiency above 90%, at a gas temperature of 1400° F., a gas velocity of not more than 400 ft/sec. was required. By using a composite filter, having fibers of 20, 8 and 4 microns diameter, removal efficiencies of 99% were obtained at gas temperatures of 1400° F. and dust loadings of 10 gr/100 CF.

E. J. Pyrcioch

Reactor Design

Corrigan, T. E. and Mills, W. C. REACTOR DESIGN FOR CATALYTIC REACTIONS - I. *Chem. Eng.*, 63, 197-202 (1956) April.

This is part of Chemical Engineering's refresher series on reactor design. Practical problems are discussed in this installment in non-mathematical terms. The longitudinal versus backmixing reactors are described for catalytic systems. Fixed and moving bed reactors as well as fluidized systems are discussed.

E. B. Shultz

11. PROCESS EQUIPMENT AND INSTRUMENTATION

Canadian Pipe Mill

Macfadyen, A. and Hilton, H. G. BIG-INCH PIPE MILL PLANNED FOR WELLAND. *Can. Gas J.*, 49, 15 (1956) March.

The large diameter pipe needed for the Trans-Canada pipeline's eastern segments will be produced in a new ten million dollar pipe-mill at Welland, Ont. A joint enterprise of the Page-Hersey Tubes, Ltd., and The Steel Company of Canada, Ltd., the mill will produce 200,000 tons/year of 20- to 36-inch diameter pipe for gas, oil, water and irrigation projects. O. P. Brysch

Cylinder Gas Safety

Crowe, J. J. SAFETY AND COMPRESSED GASES. *Ind. Eng. Chem.*, 48, 230-2 (1956) February.

Safety in the transportation and handling of compressed gases and the manufacture of the container is discussed. Containers complying with the requirements of the Interstate Commerce Commission must be periodically retested. Regulations are included. Also safety devices, valves, marketing, labelling, storing, handling and usage of the container with respect to the nature of the gas are discussed. G. Kunst

Piping Design

Hsiao, K. H., NEW METHOD FOR PIPE STRESSES. PART III: HOW TO HANDLE ELBOWS AND BENDS. *Petrol Refiner*, 35, 153-7 (1956) February.

This is the third and concluding part of a series on the calculation of stresses in a three-dimensional piping system and presents methods applicable to systems containing elbows and bends. An example is worked out for a typical loop piping installation. E. J. Pyrcioch

Valves

Beard, C. S. BASIC VALVE TYPES AND FLOW CHARACTERISTICS. *Instr. and Autom.*, 29, 490-502 (1956) March.

The article lists the advantages and operating characteristics of all of the well-known control valves. Illustrations are helpful and supplement the text. W. G. Bair

12. MATERIALS OF CONSTRUCTION

Cathodic Protection

Johnson, W. A. PITFALLS TO AVOID IN THE DESIGN OF A CATHODIC PROTECTION SYSTEM. *Pipe Line Ind.*, 4, 24-26 (1956) March.

Instructions on the design and installation of both rectifier and galvanic anode protection systems are given. Choice of system usually must be based on a survey of the local conditions to hold to a reasonable cost. Anodes of proper size (to fit the soil corrosivity) spaced at proper intervals, or at corrosive areas, are needed. Rectifier installations, providing more protective current than anodes, likewise must be properly placed, fed, insulated, and carefully maintained. O. P. Brysch

Cermets

Havekotte, W. L. HIGH-TEMPERATURE PARTS BASED ON TITANIUM CARBIDE. *Metal Progress*, 69, 56-61 (1956) April.

Cermets, containing titanium oxide with nickel and chromium in the binder and small amounts of molybdenum, have been developed and produced for high temperature applications. Application is still limited by the brittleness of the material at room temperature. E. J. Pyrcioch

Coatings

Parker, M. E. 12 MUSTS FOR A GOOD PIPE COATING JOB. *Pipe Line Ind.*, 4, 31-34 (1956) March.

A dozen brief comments, with illustrations, point out the important details in which care is required to get a good external pipe coating job. Cleaning, priming coat, reinforcement material, enamel preparation, enamel application, holiday testing, handling in storage and in field are mentioned. O. P. Brysch

Watts, J. C. WHAT TO EXPECT FROM INTERNAL COATINGS. *Pipe Line Ind.*, 4, 20-23 (1956) March.

Eight years service experience with internal vinyl coatings and 3 years with epoxy coatings on crude oil, fresh and salt water, and natural gas pipelines is briefly reviewed, with illustrations. Details of cleaning, coating application and costs per foot are given, and the advantages

of increased throughput (up to 10 per cent) and decreased pumping costs are mentioned.
O. P. Brysch

OFFSHORE OPERATORS EYE NEW COATING. *Pipe Line Ind.*, **4**, 35-36 (1956) March.
A prototype machine is described for yard coating submarine pipe to produce both weight-coatings and corrosion protection. A movable trough is charged with hot aggregate, cleaned primed pipe inserted and positioned in a mold-form, an upper mold-form shoe is pressed onto the pipe, the aggregate is condensed onto the pipe by pressure and vibration, and the pipe then cooled by internal flood and external spray of water. O. P. Brysch

Plastic Pipe

Minton, J. W., TESTS PREDICT PERFORMANCE OF PLASTIC PIPE AT LOW TEMPERATURES, *Gas*, **32**, 60-62 (1956) March.
A testing program conducted by an extruder of Tenite II of plastic pipe to determine its physical properties over a temperature of $-40°$ to $75°$F is reviewed. Properties included impact resistance and bursting pressure. G. G. Wilson

PLASTIC PIPING UP IN 1955, *Gas*, **32**, 67-69 (1956) March.
Results of a staff survey of the usage of plastic pipe by gas distribution companies are summarized. Tabulations of installed footages and types of pipe used by companies are included.
G. G. Wilson

13. NEW BOOKS

(C. A. Simms, Librarian)

Air Pollution

Mallette, F. A. (Editor) PROBLEMS AND CONTROL OF AIR POLLUTION. New York: Reinhold Publ. Co., 1955.
This book is a collection of the twenty-five papers which were presented at the First International Congress on Air Pollution in New York, sponsored by the American Society of Mechanical Engineers, March 1-2, 1955. The papers are divided into five groups: 1) general; 2) gaps in the available knowledge on air pollution; 3) current developments in air pollution; 4) sulfur dioxide-treatment and recovery; and 5) experience in air pollution abroad. The first group of two papers discusses the growth of public opinion and the management aspects of air pollution. The second group of six papers discusses some of the aspects of air pollution that require more investigation and research. More knowledge is needed on the biological effects and biological systems for the identification and distribution of air pollutants. Administration and patterns of air-pollution control require much study. In the field of control equipment, increased education at all levels is necessary to insure correctly engineered installations. Additional meteorological information is needed concerning the dispersal of natural and artificial pollutants and on special problems such as photochemical changes of contaminants by solar radiation. Current developments include more detailed information on the exhaust gases from diesel engines, formulation of design standards for multiple-chamber industrial size incinerators, and the measurement of average particle size in aerosols by light-scattering photometers. The treatment and recovery of sulfur dioxide is discussed in a group of eight papers with specific discussion and new material on various methods of removal and recovery from power plant flue gases and other combustion processes. The final section presents five papers on air pollution abroad. Air pollution in Holland, France and Italy are discussed. Experiments on the size of the dust outlet on the efficiency of cyclones are discussed. S. Close

Petroleum Engineering

Uren, L. C., PETROLEUM PRODUCTION ENGINEERING: OIL FIELD DEVELOPMENT, 4th Ed. New York: McGraw-Hill Book Co., 1956.
A revision of this standard reference book for petroleum engineers. New material has been added, and many sections rewritten.

Solar Energy

Daniels, F. and Duffie, J. A., SOLAR ENERGY RESEARCH. Madison, Wisc.: University of Wisconsin Press, 1955.
An informal report of a symposium on all phases of the utilization of solar energy. Intended to make available to everyone the status of the utilization of solar energy as of 1954. Some articles are intended for the layman and others are highly technical.

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Bituminous Coal Research Reports
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Butane-Propane News

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Gas Heat
Gas Journal
Gas Times
Gas und Wasserfach
Gas World

Heating, Piping and Air Conditioning

Independent Petroleum Association of America Monthly
Industrial and Engineering Chemistry
Industrial Finishing
Industrial Gas (American)
Industrial Gas (British)
Industrial Heating
Institute of Fuel (British). Journal
Institute of Gas Technology Publications
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